

material to this invention. This identity information is translated by appropriate electronics 24 into an actuating signal for the stepper motor 26 which turns the disc spindle 28. Mounted on the spindle 28 is a code information disc 30 whose rim 32 can be pushed into engagement with the pins 18 by the actuator arm 34 upon energization of the solenoid 36. Conventional interlock electronics 38 assure that the solenoid 36 is de-energized while the disc 30 is in motion.

The code information disc 30 is shown in more detail in FIGS. 3 and 3A. The disc 30 must satisfy two sets of inconsistent requirements: it must be radially stiff and strong but axially highly flexible, and it must be small yet carry on its rim 32 all sixty-four possible combinations of the six Braille pins 18 (the sixty-four character set can be expanded to 126 characters or more by using one or more of the characters as a prefix which appears momentarily before another character).

To satisfy the former requirement set, the disc 30 is provided with cutouts 40 between its hub 42 and its character code carrying rim 32. The cutouts 40, the thinness of the web 44 between the hub 42 and the rim 32, and the radial grooves 46 formed between the character pads 48 all cooperate to give the disc 30 considerable flexibility in an axial direction while preserving its radial and circumferential integrity. An index marker 49 may be provided to conventionally cooperate with an optical, magnetic or mechanical indexing device (not shown) to maintain the positional accuracy of the character disc 30.

The second requirement set is satisfied by arranging the character code for each character in a straight line rather than in the box format of Braille symbols. Specifically, each character pad 48 carries a character code in the form of indicia 50 (openings 50a or depressions 50b in the rim surface in FIG. 3B) whose radial positions "1" through "6" correspond to the numbers of the Braille pins 18 which remain retracted when that character is displayed.

Alternatively, the indicia 50 may be protuberances 50c (FIG. 3C) whose radial positions "1" through "6" correspond to the numbers of the Braille pins 18 which are to be extended.

The radially linear arrangement of the character codes on the character pads 48 is translated into the Braille-cell form by the eccentric push pins 18 which are shown in more detail in FIGS. 4 and 5. Each pin 18 has a flange 52 from which an eccentrically mounted finger 54 extends downwardly. As indicated in FIG. 5, the eccentricities of the fingers 54 are so oriented that the fingers 54 lie in a radial line with respect to the disc hub 42.

FIGS. 6 and 6A show the detail of the Braille pin mechanism. As best seen in the exploded view of FIG. 6A, the top plate 60 of the mouse 10 has a cavity 62 formed therein in which the pins 18 are disposed. The fingers 54 of the pins 18 are confined in guide holes 64 for proper alignment. A leaf spring 66 disposed in a channel 68 engages the upper surfaces of flanges 52 and biases them downward. The upper portions of Braille pins 18 are retained for up-and-down movement in guide holes 70 in the Braille pad 14.

FIGS. 7, 8 and 8A illustrate an alternative embodiment of the actuating mechanism of this invention. In this embodiment, the character indicia 50 (which, as in the first-described embodiment, may be recessed or protruding) are positioned on a flexible belt 72 extending over a drive pulley 74 driven by the stepper motor

26, and an idler pulley 76. The belt 72 is provided with teeth 78 which engage teeth on the drive pulley 74 to prevent the belt 72 from slipping with respect to the drive pulley 74. As in the first-described embodiment, the pressure plate 82 on level arm 34 of the solenoid 36 presses the belt 72 into engagement with the Braille pins 18 when the solenoid 36 is energized.

FIGS. 9, 10 and 10A show a third embodiment of the pin actuating mechanism of this invention, and also illustrate a method, applicable in principle to all three embodiments, of reducing the power consumption and heat generation of solenoid 36. In this third embodiment, the stepper motor 26 is pivotably supported on a swivel pin 84 in a swivel bracket 86. The swivel bracket 86 in this embodiment fixedly supports the solenoid 36. A stiff character drum 90 is fixedly mounted on the shaft 92 of stepper motor 26. The character indicia 50 are carried on the surface of drum 90.

Normally, the spring 88 biases the character drum 90 against the Braille pins 18 contained in the pad 14. When the solenoid 36 is energized, it pushes the actuator 94 to the left in FIG. 9. This causes the inclined surface 96 of actuator 94 to push the wedge arm 98 attached to stepper motor 26 downwardly against the bias of spring 88, thereby pivoting the motor 26 counterclockwise about the swivel pin 84 and pulling the character drum 90 out of engagement with pins 18. Thus, the character drum 90 can be freely rotated to another character position while the solenoid 36 is energized.

The embodiment of FIGS. 9, 10 and 10A has two advantages: the provision of a stiff character drum 90 reduces the risk of character element failure due to flexing fatigue, and the energizing of the solenoid 36 during indexing rather than during character display prevents the continuous energization of the solenoid 36 if the cursor is left on a character of the computer screen. Also, the indexing time from one character to the next is statistically shorter, on the average, than the dwell time on a character being read by the operator.

We claim:

1. Apparatus for receiving from a computer signals identifying a character at a cursor position, and displaying said character in Braille format, comprising:
  - a) means for receiving character-identifying signals from said computer;
  - b) a character code member carrying character indicia;
  - c) motor means cooperating with said receiving means and said character code member for moving said character code member into predetermined positions in response to said character-identifying signals;
  - d) a set of Braille pins positioned adjacent said character code member, each pin being movable between a retracted position and an extended position in which it projects from said apparatus;
  - e) a single solenoid;
  - f) means for operating said solenoid in response to said character code member being in one of said predetermined positions; and
  - g) actuating means operatively interconnecting said solenoid, character code member, and pins so as to move selected ones of said pins between said retracted and extended positions in response to said character code nearest said pins, and to the operation of said solenoid.